

WINDSCREEN MESH

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of the earlier filing date of co-pending U.S. Provisional Patent Application No. 62/906,556, filed Sep. 26, 2019 and incorporated herein by reference.

FIELD

[0002] An embodiment of the invention is directed to an acoustic mesh for attenuating wind noise without impacting a frequency response of an associated microphone. Other embodiments are also described and claimed.

BACKGROUND

[0003] Portable listening devices can be used with a wide variety of electronic devices such as portable media players, smart phones, tablet computers, laptop computers, stereo systems, and other types of devices. Portable listening devices have historically included one or more small speakers configured to be placed on, in, or near a user's ear, structural components that hold the speakers in place, and a cable that electrically connects the portable listening device to an audio source. Other portable listening devices can be wireless devices that do not include a cable and instead, wirelessly receive a stream of audio data from a wireless audio source. Such portable listening devices can include, for instance, wireless earbud devices or in-ear hearing devices that operate in pairs (one for each ear) or individually for outputting sound to, and receiving sound from, the user.

[0004] While wireless listening devices have many advantages over wired portable listening devices, they also have some potential drawbacks. For example, it may be difficult to achieve high-end acoustic performance from the listening devices due to the limited amount of space available within each listening device. Also, some wireless listening devices that extend into the ear canal to achieve better performance can often have an improper seal between the portable listening device and the ear canal, causing the user to experience lower quality sound. Further, the small size of wireless listening devices often causes a compromise in user interface features, blockage of sensors and/or microphones, and lower overall user experience.

SUMMARY

[0005] Portable listening devices such as earbuds may include a microphone, for example, an external microphone that picks up sounds from the ambient environment surrounding the device. For example, the microphone may pick up the user's voice, pick up ambient noise (e.g., for noise cancellation), or be used for other purposes. A microphone picking up sounds from the ambient environment may, however, be sensitive to undesirable sounds such as wind noise, particularly in cases where the microphone signal is amplified. To reduce the sensitivity of the microphone to undesirable wind noise, the instant invention includes an acoustic shield coupled to an acoustic port from the ambient environment to the microphone. The acoustic shield may be an acoustic mesh that has particular dimensions that have been found to reduce (or attenuate) wind noise (or other undesirable ambient sounds) without impacting a frequency

response of the microphone (e.g., without attenuating desired sounds such as speech). For example, the acoustic mesh may be acoustically closed at a center portion and acoustically open around a perimeter portion. The acoustically open and acoustically closed portions may be specially selected to provide the same wind protection (or attenuation) as opening the whole area (e.g., an acoustic mesh without an acoustically closed center portion) without impacting the frequency response of the microphone. In some aspects, the acoustic mesh including open and closed portions may achieve a maximum wind attenuation up to 10 decibels (dB).

[0006] In one aspect, an acoustic mesh includes a first portion that is acoustically closed; and a second portion that surrounds the first portion and is acoustically open. The acoustic mesh may be configured to provide comparable wind noise attenuation in comparison to an acoustic mesh without the first portion, without affecting a frequency response of a microphone to which the acoustic mesh is acoustically coupled. In some aspects, the first portion is at a center of the acoustic mesh. The first portion may be acoustically closed by coupling a support member to a surface of the first portion. The second portion may be near a perimeter of the acoustic mesh. The second portion may be a ring shaped portion positioned around the first portion. The first portion may include a number of portions that acoustically close different sections of the acoustic mesh. The first portion have a diameter, and the diameter of the first portion may be 1.5 cm or less. The attenuation of wind noise may be 10 decibels or less. The acoustic mesh may be coupled to an acoustic port of an enclosure that the microphone is positioned within.

[0007] In another aspect, an acoustic shielding assembly includes an acoustic mesh, a support member coupled to the acoustic mesh to acoustically close a portion of the acoustic mesh, and a dimension of the support member is selected to allow the acoustic mesh to attenuate wind noise without affecting a frequency response of a microphone to which the acoustic mesh is acoustically coupled. In some aspects, a portion of the acoustic mesh is a first portion and a second portion of the acoustic mesh surrounding the first portion is acoustically open. In some aspects, a dimension of the support member is a radius and the acoustic mesh comprises a radius that is greater than the radius of the support member. In some aspects, a diameter of the acoustic mesh is 1.5 cm or less. The attenuation of the wind noise may be 10 decibels or less. The acoustic mesh may be coupled to an acoustic port that opens to an acoustic cavity of the microphone. The support member may be a post positioned within the acoustic cavity and that extends to the acoustic mesh.

[0008] In another aspect, a portable electronic device includes an enclosure having an acoustic port that acoustically couples an acoustic cavity within the enclosure to a surrounding ambient environment; a microphone positioned within the enclosure and acoustically coupled to the acoustic cavity; and an acoustic mesh coupled to the acoustic port, the acoustic mesh having a first portion that is acoustically closed and a second portion that is acoustically open and surrounds the first portion, and wherein the acoustic mesh attenuates wind noise from the ambient environment without affecting a frequency response of the microphone. The acoustically closed first portion may prevent a wind noise from the ambient environment from entering the acoustic cavity. The acoustically closed first portion may be at a center of the acoustic mesh. A support member may extend